Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Implementation of the Local	)	CC Docket No. 96-98
Competition Provisions of the	)	
Telecommunications Act of 1996	)	

COMMENTS

BellSouth Corporation and BellSouth Telecommunications, Inc. ("BellSouth")

hereby submit their comments in response to the Public Notice released on June 20, 1996.[1]

In the Public Notice, the Commission invites interested parties to comment on a

Commission staff model that attempts to simulate the relative impact of particular changes

in the telecommunications industry. The Commission is interested in comments and

observations regarding the staff model as well as receiving variations of the model or

alternatives to the model.

To the extent that the staff model reflects the Commission's recognition that its

actions in implementing the Telecommunications Act of 1996 can have a far reaching

financial impact on the telecommunications industry and, in particular, on the local

exchange carrier segment, BellSouth supports efforts that will enhance the Commission's

understanding of the consequences of any policy determinations it may make. To that

end, however, BellSouth believes that the staff model is woefully inadequate.

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[1] Public Notice. "Supplemental Comment Period Designated For Local Competition Proceeding, CC Docket No. 96-98," DA 96-1007 IAD 96-175, released June 20, 1996.

There are numerous problems associated with the model. The model is large and its specifications are complex and undocumented severely curtailing any party's ability to critically evaluate the model. In any event, the model, on its face, substantially oversimplifies the telecommunications industry and therefore should not be used by the Commission to make policy decisions.

The United States Telephone Association (USTA) has prepared an analysis of the staff model with which BellSouth concurs. Attached to the Comments filed by USTA is the affidavit of Dr. William Taylor. Dr. Taylor's affidavit chronicles the difficulties with the staff's model. In addition, Dr. Taylor shows that despite the model's shortcomings, it illustrates how a policy misstep by the Commission could have ruinous financial consequences for incumbent local exchange carriers.

While modeling can enhance the Commission's understanding of the consequences of its actions, the Commission seems also predisposed to use modeling for pricing and costing purposes. BellSouth believes that such approaches are of dubious value. First, much is made of the Telecommunications Act's pricing standards which requires that the price of interconnection and network elements be based on cost. Many have misread this requirement to mandate a formula approach to establishing a specific price/cost relationship. AT&T and MCI have submitted a model developed by Hatfield Associates (Hatfield Model) that purports to calculate an incremental cost (more specifically a total service incremental cost) for network elements that should be mechanically converted into a price. The bottom-up approach to cost development employed in the Hatfield model is flawed in many respects as has been documented in this proceeding. Not only is the

Hatfield model clearly inappropriate for the purpose of determining costs and prices for interconnection and network elements, but also to the extent that results of this model are used as inputs to the staff simulation model, the simulation results are distorted.

Any simulation model must have reasonable inputs. If the Commission continues to seek to model cost/price inputs then it should consider approaches that go beyond bottom-up cost estimation techniques. A bottom-up approach is not the only approach to cost estimation. BellSouth is attaching a paper prepared by Strategic Policy Research that includes a description of one such top-down approach to cost estimation.[2] In contrast to the Hatfield model, an important characteristic of the top-down approach is that it reflects network costs as they actually exist.

If for no other reason, the Commission should understand that different approaches, such as a top-down approach or a bottom-up approach, are likely to yield

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[2] John Haring, Calvin S. Monson and Jeffrey H. Rohlfs, "Comments on FCC's Industry Demand and Supply Simulation Model," Strategic Policy Research, Inc., July 8, 1996.

considerably different results. Thus, the Commission would be remiss if it simply adopted

a bottom-up cost model which does not take into account actual network configurations.

Respectfully submitted,

BELLSOUTH CORPORATION
BELLSOUTH TELECOMMUNICATIONS, INC.

By:

M. Robert Sutherland
Richard M. Sbaratta

Their Attorneys

Suite 1700
1155 Peachtree Street, N. E.
Atlanta, Georgia 30309-3610
(404) 249-3386

Date: July 8, 1996

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Comments on FCC's Industry
Demand and Supply Simulation Model

John Haring
Calvin S. Monson
Jeffrey H. Rohlfs*

July 8, 1996

*   The authors are principals in Strategic Policy Research, Inc. Dr. Haring formerly served
as Chief Economist of the FCC and Chief of the Commission's Office of Plans and Policy.
Mr. Monson formerly served as Director of Telecommunications Policy at the Illinois
Commerce Commission. Dr. Rohlfs was formerly Department Head of Economic
Modeling Research at Bell Labs.

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Summary

In this submission, we briefly elaborate our suggestions for methodological improvements upon the Commission's initial effort. In general, we believe it would be beneficial to reduce the model's reliance on high-level assumptions. In our view, much of what is now assumed would perhaps be better *explained* by the model itself.

The quality of the predictive outputs of the FCC's model will also depend on the quality of the empirical information used to estimate the model and generate predictions. In this regard, costs are obviously a critical input.

Much of the discussion of costs, to date, has centered on TSLRIC. However, TSLRIC is an incomplete conception of costs for purposes of answering many pertinent regulatory questions. It can supply a starting point for analysis; but it fails to account for a variety of factors that are germane to pricing issues in telecommunications.

The TSLRIC cost estimates produced by Hatfield Associates (HAI) have received a good deal of attention and have reportedly been utilized as inputs to the Commission's demand and supply model. While certain details remain obscure, HAI estimates have been produced using a "green-field" variant of a "bottom-up" approach to cost modeling.

The bottom-up approach is not the only approach to cost estimation. A top-down approach is also possible. Indeed, a top-down approach appears to have significant advantages. First, a top-down approach reflects the network that actually exists and costs that have actually been incurred by real decisionmakers spending real money trying to optimize in a real-world business setting as the foundation for developing estimates of *forward-looking* costs. A second important advantage of a top-down approach is that it examines both the direct and indirect cost effects of incremental changes in service outputs. A bottom-up approach can only very imperfectly reflect indirect effects, which may often be substantial.

We present some results from a rudimentary top-down model of loop costs. Our model begins by examining real costs that were actually incurred by local exchange carriers. An important strength of the model is that it relies entirely on publicly-available data.

Our estimate of the incremental cost of loops substantially exceeds the estimate developed by HAI. Our estimate of $17.04 per month exceeds HAI's estimate of $13.84 per month by 23 percent. The disparity is even greater when one considers that HAI estimate TSLRIC, while our estimate of incremental cost excludes quasi-fixed costs.

The Commission should carefully consider the attributes of both top-down and bottom-up estimates of the costs of a legacy network (as opposed to a green-field model of a hypothetical network). Where those estimates differ, it should attempt to reconcile them, much in the manner OFTEL has done in the United Kingdom. It is only through a process of critical appraisal and contrast and comparison of alternatives that the Commission can produce policy transparency and clarity.

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I. Introduction

The Commission has asked for comment on its Industry Demand and Supply Simulation Model. The Commission has a responsibility to make decisions that are informed by careful analysis of potential economic impacts. The underlying economic interrelationships are exceedingly complex; so economic modeling may be beneficial. If properly designed and based on sound inputs, economic models can help enable the Commission to trace the manifold consequences of its decisions (for good or ill) in an analytically penetrating way.

We believe that the Commission can achieve substantial improvements in the model's performance. The benefits of the improvements can be worth far more, in terms of the superiority and transparency of policymaking, than they cost to produce. We believe that further effort would be fruitful both in the specification of the model and in the accuracy of observation measurements that are inputs to the model. With regard to the latter, the old adage "garbage in/garbage out" very much applies, and it is incontrovertibly important to minimize errors arising from faulty conceptualization and measurement of model inputs.

In this submission, we briefly elaborate our suggestions for methodological improvements upon the Commission's initial effort. We emphasize the desirability of a modeling approach that explains more and is less assumption-driven/dependent. We then turn to measurement issues, focusing on the debate regarding cost concepts and measurements in the interconnection context. We report the results of a rudimentary effort we have undertaken to produce a *"top-down"* estimate of incremental loop costs. Those results contrast sharply with the results of at least one notable "bottom-up" estimate. We also report on the *constructive dialogue* on these issues which has occurred in the context of OFTEL's consultation on similar issues in the United Kingdom. While we

do not regard OFTEL's pricing and costing framework as perfect, we do think it represents a good overall approach and, equally as important, we think the consultation process OFTEL utilized to produce its policy framework represents a sound process. Indeed, as we have noted, Commission consultation on its modeling effort represents a salutary step in this direction. We conclude with a brief summary of our principal conclusions.

II.   Improving the Model

We believe that a fruitful area for further work is to reduce the model's reliance on high-level assumptions. In our view, much of what is now assumed would perhaps be better *explained* by the model itself.

A model's predictions depend on its premises — indeed, a model may be broadly defined as a set of premises. The Commission's model has a great many premises. Many of these represent the *results* of the operation of different processes and interrelationships rather than *descriptions* of the processes and relationships themselves. These might be termed "higher level" as opposed to more "basic" premises. Our view is that the Commission's model could be improved by lesser reliance upon "higher level" premises and correspondingly greater reliance on "basic" premises to motivate or determine (simultaneously) higher level premises and conclusions.

Below we give a few examples of high-level assumptions that could be endogenously determined in the model.

(1)   In the current model, the price-cap productivity factor is entered as an assumption, but it obviously depends, in part, on regulatory policy. Suppose that the FCC were to adopt a handicapping policy that inhibited LECs' ability to compete, under which competitive losses

undermined LEC earnings. In that case, the productivity that LECs could achieve (while covering their cost of capital) would likely decline over time. This effect could be captured by modeling the productivity factor as a weighted average or distributed function of realized productivity over a recent set of years.

(2)   Similarly, it is likely that LEC investment programs will vary with respect to changes in regulation. Again suppose the FCC were to adopt a policy that limited or increased the likely appropriability of rewards from LEC network investments. Unfavorable treatment will presumably stifle investment, while more favorable treatment might stimulate investment. These effects could be modeled by specifying an explicit relationship relating the amount of new investment to, *inter alia*, the favorability of the regulatory climate to investment.

We recommend that as the FCC's model evolves, many of its current "assumptions" should become endogenous; *i.e.*, determined by/within the model. This will ensure greater consistency and a sounder foundation for prediction of economic impacts.

III.   "You Are What You Eat"

Obviously the quality of the predictive outputs of the FCC's model will depend on the quality of the empirical information used to develop the model and generate predictions. Quality has several distinct elements. Plainly, a model should embody economically sound principles and definitions. The empirical measures should closely correspond to theoretically relevant concepts. Accuracy of measurement is also important. If a model and its predictions are based on inaccurate measures of inappositely-defined theoretical correlatives, neither the model nor its predictions are likely to be worth much.

In the context of the FCC's implementation of the competitive interconnection provisions of the Telecommunications Act of 1996, there has been a great deal of discussion of costs. Discussions have encompassed various theoretical conceptions and empirical measures of (allegedly) relevant economic costs. Not surprisingly, costs also figure prominently in the FCC's Industry Demand and Supply Simulation Model. Costs are obviously of fundamental importance and have been the subject of considerable attention. Nevertheless, there is disagreement about what specific empirical measures of costs the FCC should utilize in its modeling effort or in carrying out its various regulatory mandates.[1]

The concept of total-service, long-run incremental cost (TSLRIC) was featured prominently by the Commission in its Interconnection Notice. TSLRIC is defined as long-run incremental costs (LRIC) plus "quasi-fixed" costs. The latter costs do not vary with output, but can be saved by discontinuing a service entirely. While TSLRIC does not figure nearly so prominently in more general price theoretic discussions, it is a useful economic concept. It is germane, in principle, for resolving the question of whether the rate for a particular service is "subsidy-free."

Of course, subsidy-free rates are not necessarily efficient, let alone "just and reasonable" and compensatory. Economists have generally agreed on the following points:

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[1]   As we stated in our earlier submission for BellSouth, we believe that terms and conditions of interconnection are best left to marketplace negotiations and oversight by state commissions which can embody and reflect idiosyncratic local detail. While cost analysis can certainly inform the FCC's policymaking, it should not be used to proscribe specific interconnection rates. *See* John Haring, Jeffrey H. Rohlfs, Calvin S. Monson and Harry M. Shooshan III, *Interconnection and Economic Efficiency,* before the Federal Communications Commission, *In the Matter of Implementation of the Local Competition Provisions in the Telecommunications Act of 1996,* CC Docket No. 96-98, *Comments of BellSouth,* filed May 16, 1996.

- Where there are economies of scale and/or scope or genuine overheads and common costs, subsidy-free rates may not recover costs and thus be inconsistent with firm viability.[2]

- This problem is exacerbated if regulators mandate that certain services be priced below TSLRIC.

- The problem is further exacerbated where past regulatory depreciation has been less than economic depreciation.

TSLRIC is thus an incomplete conception of costs for purposes of answering many pertinent regulatory questions. It can supply a starting point for analysis; it can serve a useful purpose; but it fails to account for a variety of factors that are germane to pricing issues in telecommunications.

On the theoretical *inadequacy* of TSLRIC there actually appears to be a fairly general consensus among economists. At the Commission's recent *Economics of Interconnection Panel Discussion Forum*, Robert Willig, who filed on AT&T's behalf in the Interconnection Proceeding, cited the existence of common costs as one possible reason for markups above TSLRICs (pages 155-157). He also suggested that a reasonable case could be made for recovery of the costs of prudent

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[2]   As Baumol and Sidak have observed:
Adherence to this well-known principle of marginal-cost pricing, on the belief that it maximizes the general welfare, can lead regulators astray, however. For it is equally well known that if the firm's production process is subject to economies of scale, then the requirement that prices be set equal to marginal costs is a recipe for bankruptcy. Under economies of scale, the revenues yielded by marginal-cost pricing will necessarily fall short of the total costs of the firm's outputs. . . . Thus, no regulator can be expected to follow the precept of marginal-cost pricing that is integral to the model of perfect competition, for to do so would either drive the regulated firm into bankruptcy or force government permanently to subsidize the resulting deficit. If the model of perfect competition cannot offer the regulator useful guidance on price regulation, it is virtually worthless as a model for an agency charged with regulating prices. [Footnote omitted.]
See William J. Baumol and J. Gregory Sidak, *Toward Competition in Local Telephony* (The MIT Press and The American Enterprise Institute for Public Policy Research, 1994), pp. 34-35.

investments obsoleted by change (page 159).[3] He also suggested that it might be proper to include the costs of regulatory burdens in the latter category (pages 159-160). Willig also suggested that it would be *improper* to recover costs that are not costs of the service being priced — a view which argues as much against restrictions on efficient rate rebalancing (eliminating cross-subsidies that regulators often like) as against anticompetitive cross-subsidy (pages 157-158).

To this list, one might add that rates should not embody monopoly profits. Monopoly profits within a price-cap regime should not, however, be construed to include high realized rates of return that reflect extraordinary performance.[4] The point is that while economists may fly under different flags, there is only one economics and no such thing as a free lunch.

It may appear superficially that Baumol and Willig recant the above views in their recent affidavit for AT&T (jointly with J. A. Ordover).[5] In that affidavit, they argue for using TSLRIC as

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[3]   Relatedly, Gerald Brock, former Chief of the FCC's Common Carrier Bureau, observed at the Forum that if regulators do not permit recovery of efficient past investments,

> There's an old saying in Boston. Fool me once, your fault. Fool me twice, my fault. I think we are going to see the discount rates become very high in this type of situation. . . . [I]n calculating TSLRIC, the idea of using an 11 percent discount rate is all wrong. You're talking a 20-25 percent discount rate. . . . I don't think anyone should sit here today and think that a private firm in competition is going to use an 11 percent discount rate" (pp. 33-34).

[4]   *See* John Haring, "Can local telecommunications be self-policing?," *Telecommunications Policy* (March 1995); Jeffrey H. Rohlfs, John Haring and Harry M. Shooshan III, *Regulatory Reform for the Information Age: Providing the Vision,* January 11, 1994; and John Haring and Jeffrey H. Rohlfs, *Telecommunications Pricing for Efficient Local Competition,* January 10, 1996. Similarly, note well that were the FCC to compel uneconomic pricing of interconnection inputs, it would, in effect, abrogate the government's price-cap commitments and prevent LECs from reaping the fruits of their efforts to economize and innovate. The credibility of the government's commitment is widely regarded as a key determinant of a price-cap regime's success.

[5]   Affidavit of William J. Baumol, Janusz A. Ordover, and Robert D. Willig, before the Federal Communications Commission, In the Matter of Implementation of the Local Competition Provisions in the Telecommunications Act of 1996, CC Docket No. 96-98, *Comments of AT&T*

a benchmark for pricing to competitors. However, in ¶¶ 22 through 24, they disclose that their position is based on the assumption of thorough-going rebalancing of LEC rates to improve economic efficiency. In reality, the Commission must act on interconnection pricing before it can restructure access charges. Furthermore, the access restructuring that the Commission ultimately implements may fall far short of that envisioned by Baumol, Ordover and Willig. In addition, the Commission, so far as we know, does not contemplate rebalancing rates within state jurisdictions; *e.g.,* raising local residential rates and lowering intraLATA toll rates. Under these circumstances, the premise for pricing competitive inputs at TSLRIC disappears. Under the conditions that actually exist in the real world, pricing competitive inputs at TSLRIC would invite entry by inefficient competitors and could substantially reduce the productivity of the telecommunications industry.

IV.   Bottom-Up Versus Top-Down

The TSLRIC cost estimates produced by Hatfield Associates (HAI) have received a good deal of attention and have reportedly been utilized as inputs to the Commission's demand and supply model. While certain details remain obscure, the HAI estimates have been produced using a "green-field" variant of a "bottom-up" approach to cost modeling. As Robert Crandall noted at the FCC's *Forum* (p.38), approaches such as HAI's differ significantly from the TSLRIC estimates that have been generated in the past for regulatory purposes. HAI do not look at forward-looking costs of the *existing network*, but rather at "the most efficient possible network design."

As Crandall remarked:

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[5]   (...continued)
Corp., May 16, 1996.

It seems to me that once we get into this mode, we are suggesting a rather considerable arrogance on the part of economists and regulators if they can figure out what the optimal network would be in the future. Do they know what competition would generate here in terms of the form of the network? And particularly, one has to suspend belief when people who would like to enter suggest that they could improve upon the performance of the existing network. For them to suggest that ought to lead to a response from regulators to invite them to do it, and in fact to insist that they do it as a demonstration project (p. 38).

As we noted earlier, pricing should reflect efficient operations. However, the fact that existing operations are necessarily based on a legacy network does not imply inefficiency.[6] Technical advance implies that network components purchased today are more technically efficient than those purchased yesterday; that does not make them more economically efficient. Indeed, starting from scratch every day would presumably be very inefficient. And, as we have observed, there is consensus that legacy costs of a firm subject to regulation (at least those "prudently incurred") should be recoverable.

As Crandall's remark suggests, the bottom-up approach is not the only approach to TSLRIC estimation. A top-down approach is also possible. Indeed, a top-down approach appears to have significant advantages. First, a top-down approach reflects the network that actually exists and costs that have actually been incurred by real decisionmakers spending real money trying to optimize in a real-world business setting as the foundation for developing estimates of *forward-looking* costs. Apart from the problem of hubristic arrogance noted by Crandall, the "green field" approach is largely

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[6] As Shooshan and Richardson have observed,
Network planning is not a static process. Even if we could agree on what is 'state-of-the-art' today, that picture would undoubtedly change as time — and the process of actual network deployment — continued. The network we end up with would likely look much different than the original blueprint.
These authors remark that one advantage of a legacy network is that you could make calls on it yesterday unlike an imaginary "green field" network. *See* Harry M. Shooshan III and Ross M. Richardson, *Comments on Hatfield Study,* prepared on behalf of BellSouth for submission before the Federal Communications Commission, *In the Matter of Implementation of the Local Competition Provisions in the Telecommunications Act of 1996,* CC Docket No. 96-98, *Reply Comments,* filed May 30, 1996.

hypothetical and not tied directly to reality — hardly a seeming strength for *empirical* inquiry. Similarly, the top-down approach is more authentically *incremental*. It does not ask what the incremental cost of particular outputs would be were the whole network optimized from scratch using the latest and greatest technology — obviously a radical, thoroughly nonincremental conception. Instead, it takes actual experience with the existing network as a base. It then evaluates the forward-looking costs of changes in outputs.

A second important advantage of a top-down approach is that it examines both the direct and indirect cost effects of incremental changes in service outputs. A bottom-up approach can only very imperfectly reflect indirect effects, which may often be substantial. For rational economic decision-making, indirect costs must be considered, as well as direct costs. Again, we note that, while economists have different views about the empirical significance of indirect costs, there is consensus about the need for their recovery. If the Commission were to utilize cost input measures in the modeling effort which significantly understate actual costs, its estimates of financial and economic impacts are not likely to represent accurate assessments of impacts.

Table 1 summarizes several possible approaches to estimating incremental costs. The incremental cost estimates that have most frequently been used in regulatory proceedings fall in the bottom-up, legacy category.[7] The approach used in the recent HAI analysis falls in the bottom-up, green-field category. The estimation approach we presently describe in this submission falls in the top-down, legacy category. In our view, approaches that exploit the experience of building and operating today's "legacy" network to develop forward-looking cost estimates are likely to prove more useful for the Commission's purposes than green-field estimates. Regulators need to assess the

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[7]   Examples in this category include Bridger Mitchell's California study and the recent Benchmark Cost Model (BCM) developed by several carriers.

impacts of their actions on the real-world network — not on a hypothetical network that exists only in someone's mind. While both bottom-up and top-down approaches can produce useful insights, top-down estimates can properly take account of indirect variable costs that a bottom-up approach would regard as a residual and mischaracterize as an overhead.

Table 1 Cost Estimation Methods		
	Bottom-Up	**Top-Down**
Legacy	• Can be used to estimate direct costs. • Based on real-world experience in operating networks.	• Can capture both direct and indirect costs of producing broad classes of outputs. • Based on real-world experiences in operating networks.
Green Field	• Based on nonexistent hypo-thetical network.	N/A

We can actually offer the Commission some idea of the magnitude of the differences these different modeling approaches are likely to imply about costs. We have generated an estimate of incremental loop costs utilizing a rudimentary top-down approach. It suggests that, as output increases, indirect cost changes can be quite substantial. We think the results are interesting and suggest the need for some additional hard thinking about costs and their measurement.

V. Top-Down Analysis of Loop Costs: A Rudimentary Model

In this section we present some results from a rudimentary top-down model of loop costs. [8] Although the model is rudimentary, the results are interesting in their own right. They also provide a specific context for discussing methodological differences between the top-down and bottom-up approaches. We contrast the results of our rudimentary model with the results of HAI's bottom-up model.

A. Data

The data we used are public information filed at the Commission by the National Exchange Carrier Association (NECA). NECA uses these data to calculate the average cost per loop for each carrier for each state in which the carrier operates.

In calculating average loop costs, NECA directly assigns loop investments. It allocates additional costs to loops based on relative investments. Nine different procedures are used to allocate various kinds of investments and expenses. NECA's methodology follows the Commission's rules for purposes of determining eligibility for Universal Service Funds.

We use the NECA data for a different purpose. We use them for econometric estimation of incremental cost. Our cost analysis uses NECA's costs as inputs. We do *not*, however, assume that all costs assigned or allocated to loops are incremental costs. Econometric methods are used to determine which costs are marginal and which costs are fixed, independent of output.

Our estimates of incremental cost do not include quasi-fixed costs, which can be saved only by discontinuing a service. Quasi-fixed costs cannot, in principle, be estimated by econometric methods — unless the service actually was discontinued somewhere within the sample. The

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[8] The method adopted here may also be utilized to estimate incremental costs associated with switching and transport.

corresponding estimates of TSLRIC, which includes quasi-fixed costs, would be somewhat higher than our estimates of incremental cost.

We use data for the seven Regional Bell Operating Companies (RBOCs) for 1993, 1994, and 1995. For each year, we have 48 observations — one for each state served by an RBOC. These data include 47 of the 48 contiguous United States (except Connecticut, which is served by Southern New England Telephone) plus the District of Columbia. The total sample consists of 144 observations.

B.   The Model

Our econometric model distinguishes between capital and noncapital costs. The former includes return to capital (debt and equity), depreciation expense, and taxes. Annual capital costs are estimated by applying an annualizing factor to marginal investment (net of accumulated depreciation and deferred income taxes). Noncapital costs consist of operating expenses other than depreciation and taxes.

Our model allows for the full range of possibilities for incremental versus nonincremental costs. At one extreme, net investment and noncapital costs could be proportional to the number of loops. There would then be no economies of scale associated with telephone density. Marginal loop cost would approximate average loop cost, as calculated by NECA.

At the other extreme, the costs of providing loops could be entirely fixed. They would, of course, depend on the size of the geographic area to be served. However, they would not depend on the number of loops provided within that geographic area. In this model, the incremental cost of loops is zero.[9]

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[9]   Even though incremental cost is zero, TSLRIC would not be. Some loop costs, particularly the costs of loop investments, would be quasi-fixed costs if they were not incremental costs. Thus, they would be included in TSLRIC.

The econometric model uses actual data to determine the degree of marginality of costs. It provides an estimate of the economies of scale associated with telephone density. As expected, the estimate lies in between the two extremes, discussed above.

The model also provides an estimate of the time trends associated with loop costs. We can therefore see how loop costs are changing over time (apart from the effects of changing density of telephone penetration).

C.   Estimation Results

1.   Telephone Density

- Our estimate of marginal loop investment is 88 percent of average loop investment. For investment, the economies of scale associated with telephone density are 12 percent.

- Our estimate of marginal noncapital loop costs is 93 percent of average noncapital loop costs. For noncapital costs, the economies associated with telephone density are 7 percent.

2.   Time Trend

The model was estimated on nominal data, unadjusted for inflation. During the period 1993-1995, inflation averaged 2.4 percent per year. The estimated time trends must be interpreted relative to that inflation rate.

The estimated time trend for net loop investment was -0.4 percent per year. Thus, *real* incremental loop investment (per loop) declined by approximately 2.8 percent per year. In addition, real investment declined further as a result of scale economies associated with increases in telephone density.

The estimated time trend for noncapital costs is +4.2 percent per year. Thus, real noncapital loop costs increased by approximately 1.8 percent per year. However, this increase was partially offset by scale economies associated with increases in telephone density.

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These time trends can be used to generate forward-looking estimates of costs. That is, they can be used to extrapolate the cost functions into the future.

3. Calculation of Incremental Cost

Table 2 shows incremental loop costs for each state for each year. Costs range from a low of $5.54 per month in the District of Columbia to a high of $29.65 per month for Vermont. The average of these estimates of incremental loop cost, weighted by number of access lines, is $17.04 per month.

D. **Properties of the Model**

This section considers the properties of our rudimentary model of loop costs. The model appears to offer a very promising approach for cost estimation.

1. Top-down Approach

Our model uses a top-down approach. It begins by examining real costs that were actually incurred by local exchange carriers. As previously discussed, top-down models can take account of indirect effects, that are typically excluded in bottom-up models.

The top-down approach is often used to develop estimates of average (embedded) costs or fully-distributed costs. Our analysis demonstrates that top-down models can also be used to estimate incremental costs. Our model is *not* a model of LEC revenue requirements. On the contrary, pricing loops at our estimates of incremental costs would not suffice to recover the full cost of loops, as estimated by NECA.

2. Publicly-available Data

An important strength of the model is that it relies entirely on publicly-available data. Indeed, NECA data are available for *all* telephone companies — not just the RBOCs, analyzed in the short time frame within which this study was completed.

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Table 2 Incremental Costs of Loops (Dollars per Month)			
State	1993	1994	1995
Alabama	$18.62559	$18.81941	$18.19313
Arizona	18.97918	18.58086	20.27735
Arkansas	21.33260	22.33323	22.49084
California	13.40258	13.93765	13.38007
Colorado	16.19795	16.49741	19.37216
Delaware	15.09813	15.67339	16.12321
District of Columbia	5.53778	5.75928	5.81397
Florida	22.85909	23.73640	23.14900
Georgia	22.03039	22.61140	22.65567
Idaho	17.28293	17.70391	19.59500
Illinois	11.36822	10.99900	11.49920
Indiana	15.96987	15.15565	15.56867
Iowa	11.00157	11.68692	12.30329
Kansas	17.52551	18.60683	18.99394
Kentucky	20.72559	21.08074	21.12832
Louisiana	22.32887	22.03201	21.96699
Maine	22.93894	24.02693	25.56421
Maryland	15.25742	15.03765	16.08508
Massachusetts	15.52582	16.68211	17.02065
Michigan	16.35880	15.41276	15.78237
Minnesota	13.92729	14.43964	15.84221
Mississippi	24.99579	25.41933	25.65738
Missouri	13.24953	15.63448	15.58573
Montana	19.09957	20.16256	21.60868

Table 2 Incremental Costs of Loops (Dollars per Month)			
State	1993	1994	1995
Nebraska	$13.44443	$13.47096	$14.76519
Nevada	18.74971	18.96928	18.65457
New Hampshire	24.27659	24.90997	25.14799
New Jersey	14.41803	14.36070	15.03808
New Mexico	19.07423	19.48445	21.54271
New York	18.33674	18.64197	20.03025
North Carolina	22.64361	23.75055	23.27093
North Dakota	18.00938	17.59216	18.17983
Ohio	15.59257	14.89832	16.04461
Oklahoma	17.99260	18.91108	18.64730
Oregon	17.30280	18.30952	19.89608
Pennsylvania	13.96420	14.30621	15.15791
Rhode Island	15.31938	16.15863	17.31053
South Carolina	27.83122	28.73774	27.99480
South Dakota	16.56020	16.87839	16.84123
Tennessee	19.20903	19.48936	20.32676
Texas	17.45887	17.99169	17.81801
Utah	13.79674	14.12398	15.12139
Vermont	27.23275	28.90183	29.65081
Virginia	16.96527	17.19863	17.69792
Washington	14.35872	15.23781	15.36734
West Virginia	25.53944	25.70674	26.12201
Wisconsin	14.81754	14.52409	14.23462
Wyoming	26.19894	26.40717	28.71314

3. Cost Allocations

Our model accepts the procedures that NECA uses to identify loop costs. In the short time available for this study, we had no practical alternative. However, several of NECA's procedures could be refined (for purposes of estimating incremental costs) in a fuller-blown analysis. While we accept NECA's identification of the costs related to provision of loops, we avoid making the assumption that all such costs are marginal. Our use of the NECA data is as follows:

- Instead of analyzing total LEC costs, we examine only a subset of those costs. That subset is identified by NECA as being related to the provision of loops. We then determine how this subset of costs varies, depending on quantity of loops provided and the passage of time. (Other cost factors could and should be considered in a fuller-blown cost analysis.) We disregard the costs that are *not* identified by NECA as being related to the provision of loops.

This methodology has definite advantages where loop costs are separable from other costs. For example, loop investment and loop maintenance costs are caused primarily by the provision of loops. That prior information is useful for econometric analysis and leads to more precise estimation.

Allocations of common costs are more problematic. Such allocations may be reasonable proxies for incremental costs where the common costs depend on the size of the firm. In any event, our econometric methods counteract, at least in part, allocations that do not correspond to incremental costs. Such allocations increase average loop costs, as calculated by NECA. However, in such cases the identified costs would be less correlated with number of loops, and our estimated ratio of incremental costs to average costs would be correspondingly reduced.

E. Comparison with HAI's Estimates of Loop Costs

Our estimate of the incremental cost of loops substantially exceeds the estimate developed by HAI. Our estimate of $17.04 per month exceeds HAI's estimate of $13.84 per month by 23 per-

cent. The disparity is even greater when one considers that HAI estimate TSLRIC, while our estimate of incremental cost excludes quasi-fixed costs.

The primary reasons for this large disparity have already been discussed.

- Our model reflects actual expenditures in the real world. HAI's model reflects an idealized network that has never been built and on which no call has ever been completed.

- Bottom-up (engineering) models have a well-known tendency to understate costs. The reason is that they do not include indirect cost effects, which are often extremely difficult to model, using an engineering approach.

Neither our estimates nor those of HAI include marketing costs. Marketing costs must be added to get defensible estimates of incremental costs of local service. HAI justify the exclusion of marketing costs by claiming, ". . . in today's world, basic dialtone does not have to be marketed."[10] HAI justify excluding such costs in their more recent study because, "Customer operations expenses will be minimal in the case of selling unbundled network elements."[11] In reality, the sale of virtually all goods and services requires significant customer contact. At a minimum, customers order changes in service and make billing inquiries from time to time. Customer assistance is also required when customers encounter problems. These services are necessary, irrespective of whether the customer is an end user or an intermediary.

HAI compare the level of their cost estimates to the prices of local exchange services. They attribute the difference to "excessive rates." Most of the difference they cite might more accurately be described as the degree to which their hypothetical model fails to reflect real-world telecommunications.

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[10]   Hatfield Associates, Inc., *The Cost of Universal Service*, p. 18.

[11]   Hatfield Associates, Inc., *The Cost of Basic Network Elements: Theory, Modeling and Policy Implications*, p. 44.

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